



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.06.2009 Bulletin 2009/26

(51) Int Cl.:
H04Q 11/04 (2006.01)

(21) Application number: **07291580.4**

(22) Date of filing: **20.12.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

- **Verlinden, Jan**
2160 Wommelgem (BE)
- **Gendarme, Christophe**
2018 Antwerpen (BE)

(71) Applicant: **Alcatel Lucent**
75008 Paris (FR)

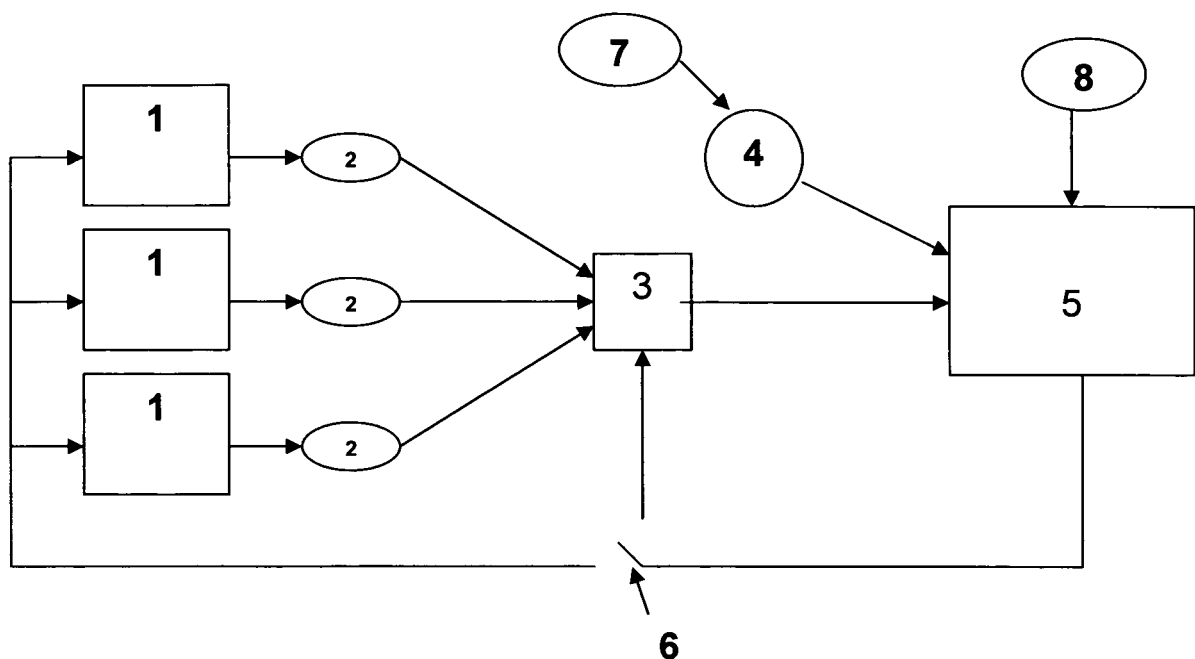
(74) Representative: **Sayettat, Julien Christian**
Strato-IP
BL 57 - 14, rue Solleillet
75020 Paris (FR)

(72) Inventors:
• **Defoort, Frank**
9150 Kruikebeke-Bazel (BE)

(54) **Access multiplexor integrating a power management system of the ports**

(57) Access multiplexor comprising ports (1) and integrating power management system of the ports (1), said system comprising a feed-back loop between means for summing (3) the power consumption of each man-

aged port (1) and each of such ports (1), said feed-back loop comprising means to configure individually at least one port parameter according to a given power consumption budget (4) for the access multiplexor.



Description

[0001] The invention relates to an access multiplexor, for example a Digital Subscriber Line Multiplexor (DSLAM), integrating power management system of ports and a power management process of an access multiplexor.

[0002] A Digital Subscriber Line Access Multiplexer (DSLAM) allows telephone lines to enable triple play services (internet, phone, video), quality of service. It is a network device connecting multiple customers Digital Subscriber Lines (DSL) to a high-speed Internet backbone line using multiplexing techniques.

[0003] Current DSLAM densities are rapidly increasing, and the gap between the dimensioning rules and the effective use is increasing, causing cost and density problems.

[0004] The power dissipation capacity of DSLAM is based on an estimation of the static worst case of power dissipation of said DSLAM.

[0005] In a known manner, in order to reduce power consumption, the DSL operator can either change some operational parameters (e.g reduce the aggregate transmit power, limit bit rate, limit the Signal-to-noise Ratio margins limit the PSD Mask,...) of DSL ports manually, either limit the number of subscribers of a DSLAM. However, this approach is creating a costly overhead like manual intervention, and can hardly be sustained as a DSLAM represents thousands of lines, which can dynamically be switched on/off and consequently suffer from external conditions changes.

[0006] The purpose of the invention is to resolve the problems of the prior art by proposing, in particular, an access multiplexor integrating a power management system with a feed-back loop in order to configure individually ports parameters according to a given power consumption budget for the access multiplexor.

[0007] For that purpose and according to a first aspect, the invention relates to an access multiplexor comprising ports, wherein the access multiplexor integrates power management system of the ports, said system comprising a feed-back loop between means for estimating, summing the power consumption of each managed port and each of such ports, said feed-back loop comprising means to configure individually at least one port parameter according to a given power consumption budget for the access multiplexor.

[0008] According to a second aspect, the invention relates to power management process of an access multiplexor wherein at least one parameter of each port is configured according to a comparison between the sum of power consumption of each port and a given power consumption budget for the access multiplexor.

[0009] Other aspects and advantages will become apparent in the following description made with reference to the appended figure that illustrates the carrying out of the process according to an embodiment of the invention.

[0010] The present invention concerns an access mul-

tiplexor comprising ports 1, said access multiplexor integrates power management system of the ports 1. It notably applies to DSLAM, but it could also be applicable to other access technologies, like wireless, optical...

[0011] At a stage of the power management process, power consumption is measured individually by a power consumption sensor 2 for each DSL port or grouped ports 1, which are then summed together. In the appended figure, only 3 DSL ports 1 are represented, but typically a DSLAM could integrate thousands of DSL ports 1.

[0012] The power management system comprises a feed-back loop between means for summing 3 the power consumption of each managed port 1 and each of such ports.

[0013] A power consumption model 5 for calculating individually the ports parameters is established according to a power consumption budget 4 and the actual power consumption from the summation function 3, power consumption budget 4 being an independent input of the power consumption model 5.

[0014] The power consumption budget 4 is determined considering the maximum power consumption/temperature allowed in the DSLAM.

[0015] The power consumption model 5 uses historical data from the power consumed by the ports 1 as previously configured, such as power dissipation of the DSLAM, specific operator configuration, measured power consumption of each DSL port 1, a mathematical model of the temperature/power dissipation, or estimated loop length. The power consumption model 5 also takes into account the power consumption 8 of those elements within the DSLAM which scale or do not scale with the power consumption of the DSL ports, for instance fans, Network Termination elements, rack control elements, other non-DSL Line Termination elements,...

[0016] The power consumption model 5 configures individually at least one port parameter according to a comparison between the sum of the power consumption of each port 1 and the given power consumption budget 4. In addition, power consumption budget 4 is influenced by inputs 7 such as temperature sensors, maximum temperature parameters, other sensors, other configuration parameters.

[0017] The power consumption model 5 notably provides control parameters of the configuration like switch on/off DSL port, force low power / low traffic states of DSL ports, and static configuration management (aggregate transmit power, frequency range, maximum bit rate, maximum Signal-to-Noise Ratio margin).

[0018] The power manager system adapts DSL ports configuration within the limit of individual subscribers' contracts.

[0019] For example, if the contract with subscriber allows so, DSL ports 1 of lines which have not been used in the last hour can be switched off.

[0020] In another way, the power management system can be configured such that it can police configurations / expectations for instance by refusing to add new sub-

scribers to the DSLAM when the maximum power budget is reached, according to its defence strategy.

[0021] DSL ports 1 of subscribers having a contract which allows a higher error rate and/or resynchronisations (typically users without voice or video over DSL) can be reconfigured with a lower Signal-to-Noise Ratio margin.

[0022] In order to improve the power consumption model 5, the power management system comprises a switch 6 for by-passing the feed-back loop at the ports side. As such, a new configuration can be emulated, without actually changing the line parameters.

[0023] When using the by passed loop the power consumption of each DSL port 1 is derived from its configuration parameters. The calculating stage is iterative and can use many trial-configurations and corresponding DSL ports 1 power consumption until reaching the best adapted DSL ports configuration.

[0024] Switch 6 is then no longer by-passed and the power management model 5 is then applied to configure the DSL ports 1.

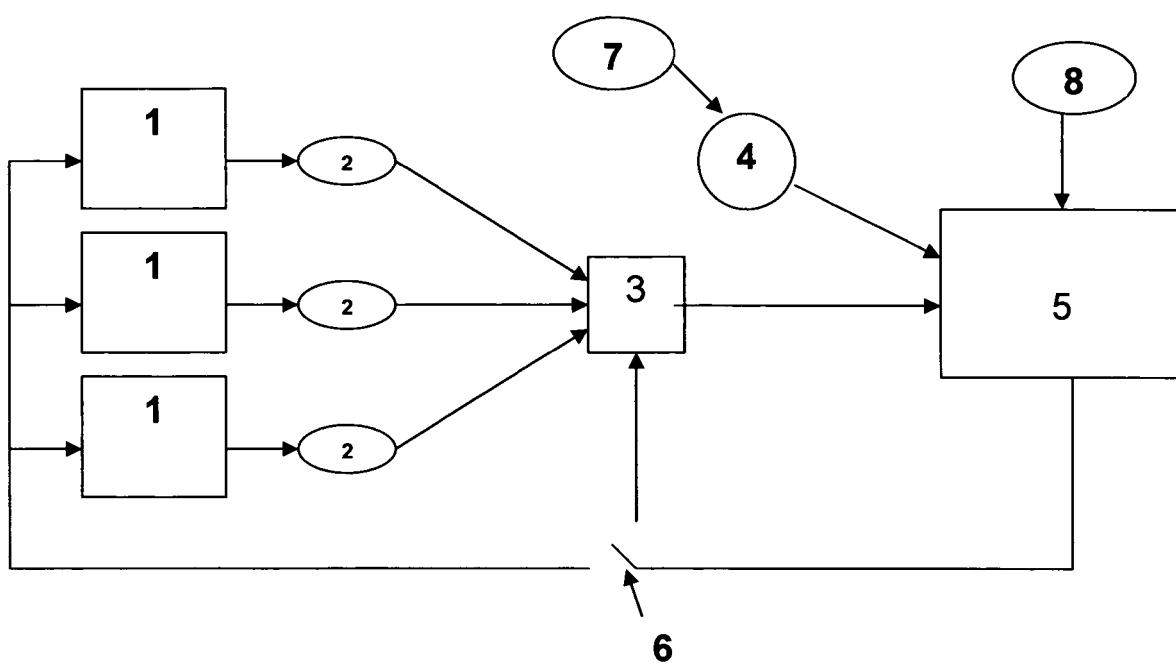
[0025] By using actual input of the power consumption instead of worst case, the power management system could reduce power consumption budget of 30% with respect to previous methods and without compromise. Such power saving also corresponds to a more efficient use of energy in DSLAM, for instance converters can be designed for lower power and work with higher load

Claims

1. Access multiplexor comprising ports (1), **characterised in that** the access multiplexor integrates power management system of the ports (1), said system comprising a feed-back loop between means for summing (3) the power consumption of each managed port (1) and each of such ports, said feed-back loop comprising means to configure individually at least one port parameter according to a given power consumption budget (4) for the access multiplexor.
2. Access multiplexor according to claim 1, **characterised in that** the power management system comprises power consumption sensor (2) of each port (1).
3. Access multiplexor according to claim 1 or 2, **characterised in that** the configuration means comprises a power consumption model (5) for calculating individually the ports parameters according to the power consumption budget (4).
4. Access multiplexor according to claim 3, **characterised in that** the configuration means further comprises a switch (6) for by-passing the feed-back loop at the ports side, said by-passed loop comprising the power consumption model (5) in order, before the

ports configuration, to be able to calculate the power consumption of each managed port (1) according to the model (5).

5. Power management process of an access multiplexor, wherein at least one parameter of each port (1) is configured according to a comparison between the sum of power consumption of each port (1) and a given power consumption budget (4) for the access multiplexor.
6. Power management process according to claim 5, wherein the ports power consumptions are measured individually.
7. Power management process according to claim 5 or 6, wherein power consumption model (5) is used to configure the ports (1).
8. Power management process according to claim 7, wherein, before the ports configuration, it provides with a stage of calculating the power consumption of each port according to the model (5).
9. Power management process according to claim 8, wherein the calculating stage is iterative with the summing of the calculated power consumption of each port (1) and the comparison of such sum with the power consumption budget (4).
10. Power management process according to any of claims 7 to 9, wherein the power consumption model (5) uses historical data from the power consumed by the ports (1) as previously configured.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 29 1580

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/044326 A (ADAPTIVE SPECTRUM AND SIGNAL A [US]) 19 April 2007 (2007-04-19) * page 41, line 28 - page 42, line 4 * * page 46, line 14 - page 49, line 18 * * figures 16A,16B *	1,5	INV. H04Q11/04
A	-----	2-4,6-10	
X	US 7 133 419 B1 (HENDRICHS LAURENT [US] ET AL) 7 November 2006 (2006-11-07) * column 7, lines 43-51 * * column 9, line 56 - column 10, line 7 * * figures 10,17 *	1,5	
A	----- WO 03/081942 A (IBM [US]) 2 October 2003 (2003-10-02) * page 2, line 15 - page 3, line 6 * * claims 1,12 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			H04Q
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		12 June 2008	Gijssels, Willem
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 29 1580

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-06-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007044326 A	19-04-2007	NONE	
US 7133419 B1	07-11-2006	NONE	
WO 03081942 A	02-10-2003	AT 304784 T	15-09-2005
		AU 2003224007 A1	08-10-2003
		CN 1640183 A	13-07-2005
		DE 60301620 D1	20-10-2005
		DE 60301620 T2	14-06-2006
		JP 3995655 B2	24-10-2007
		JP 2005521351 T	14-07-2005